Starter Question

The coordinates of two points are $A(3, 4)$ and $B(9, 10)$

Write down the vector $\overrightarrow{AB}$

What is the magnitude of $\overrightarrow{AB}$? Express your answer in the form $p\sqrt{2}$

Write down the unit vector parallel to $\overrightarrow{AB}$

Is $\overrightarrow{AB}$ parallel to $3\mathbf{i} + 6\mathbf{j}$?
Justify your answer.

Starter Question

a	$\overrightarrow{AB} = \begin{pmatrix} 6 \\ 6 \end{pmatrix}$	**B1**	
b	$\sqrt{6^2+6^2}$ $= \sqrt{72} = 6\sqrt{2}$	**M1** **A1**	Just M1 if not simplified
c	$\frac{1}{6\sqrt{2}}\begin{pmatrix} 6 \\ 6 \end{pmatrix} = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$	**B1**	
d	No $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ not parallel to $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ One vector is not a simple multiple of the other	**R1**	

J Vectors

J2

Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form.

Assessed at AS and A-level

Teaching guidance

Students should be able to answer questions using vectors in two dimensions.

6.2 Components of a vector

Converting Vectors into Component Form

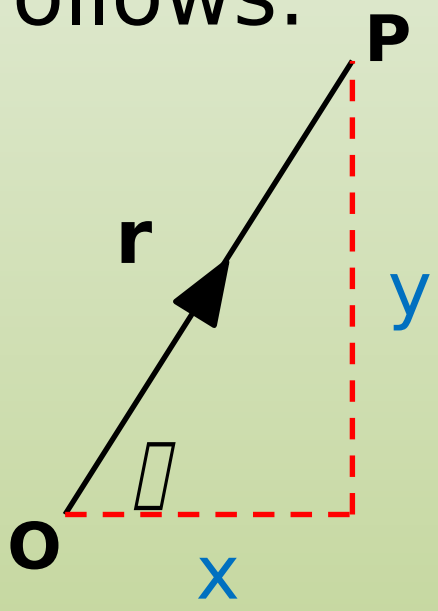
Consider the vector with magnitude and direction to the positive -axis.

Converting into **i** and **j** components or a column vector is known as resolving into components.

6.2 Components of a vector

To resolve the vector into component form, we need the values of x and y.

These can be found using basic trig as follows:



i component (x-value):

6.2 Components of a vector

To resolve the vector into component form, we need the values of x and y.

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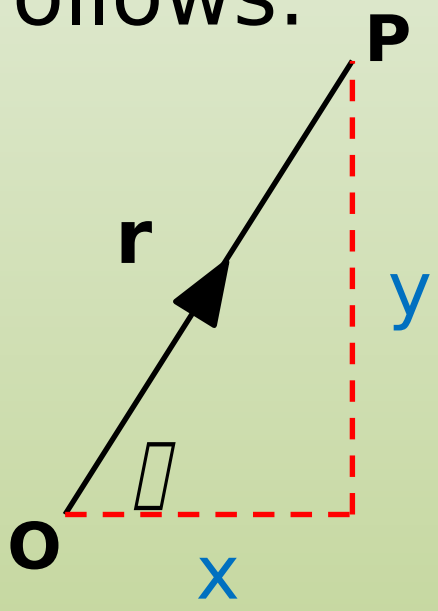
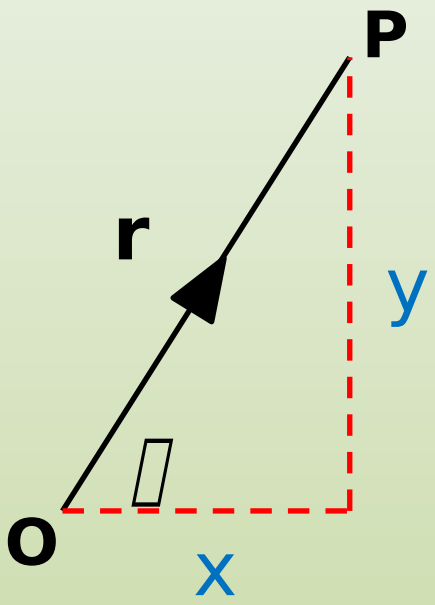


j component (y-value):

6.2 Components of a vector

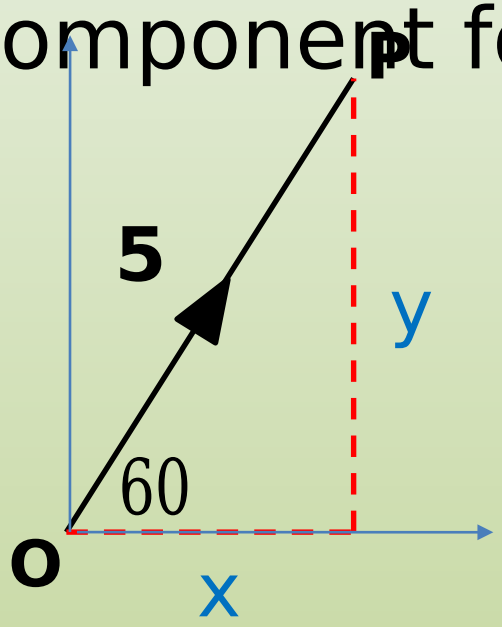


Or

6.2 Components of a vector

Example 1a

Express the following vectors in component form:

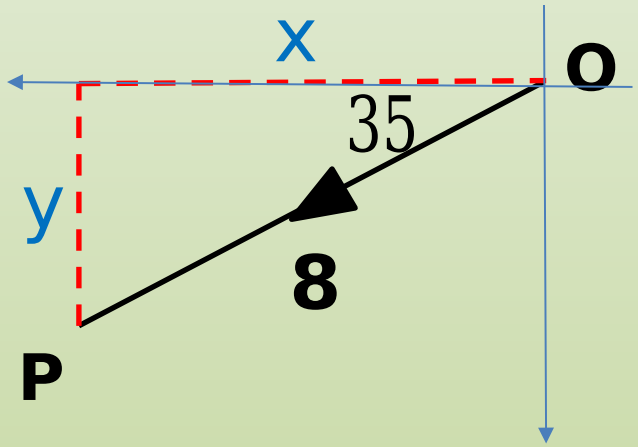


Or

6.2 Components of a vector

Example 1b

Express the following vectors in component form:



Since x and y are in the negative **i** and **j** directions then:

Or

6.2 Components of a vector

Exercise 6.2A

A cricket ball is hit at ground level on a horizontal surface.

It initially moves at 26 m s^{-1} at an angle of 50° above the horizontal.

(a) Find the horizontal component of the ball's initial velocity, giving your answer to two significant figures.

(b) Write down the initial velocity of the ball as a vector in the form $a\mathbf{i} + b\mathbf{j}$

a) So the horizontal component is 17m/s to 2sf.
b) $17\mathbf{i} + 20\mathbf{j}$

J Vectors

J4

Understand and use position vectors; calculate the distance between two points represented by position vectors.

Assessed at AS and A-level

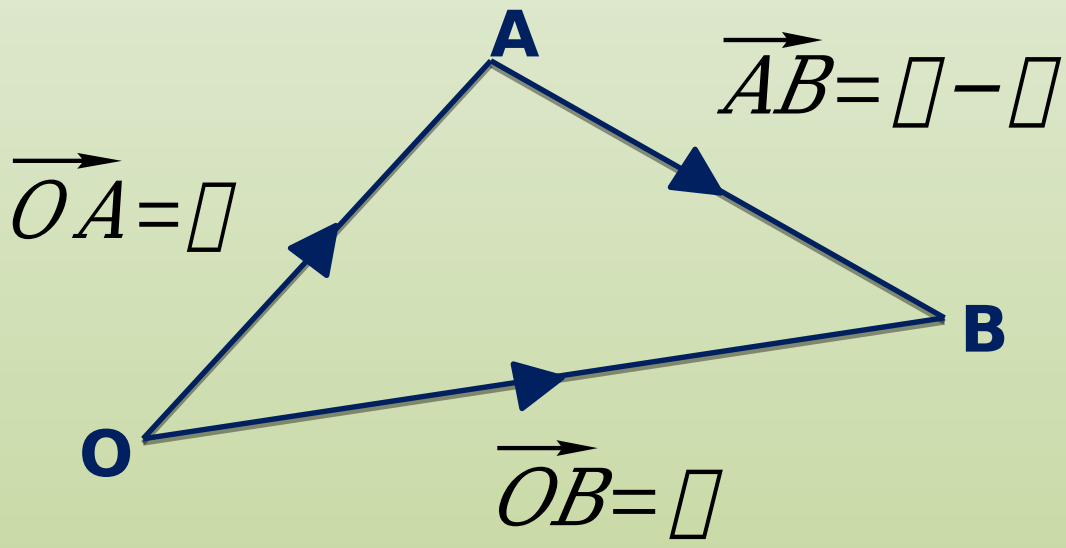
Teaching guidance

Students should be able to:

- understand and use the result $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$
- use position vectors in both a pure context and in mechanics questions, for example in kinematics.

6.2 Components of a vector

The vector is known as a **direction vector** or a **relative position vector**. That is the position vector of B relative to A.



6.2 Components of a vector

Example 2a

Consider the points with coordinates C(-1, 2) and D(4, -3).

a) Write down the position vectors of points C and D

c = -**i** + 2**j** OR

d = 4**i** – 3**j** OR

6.2 Components of a vector

Example 2b

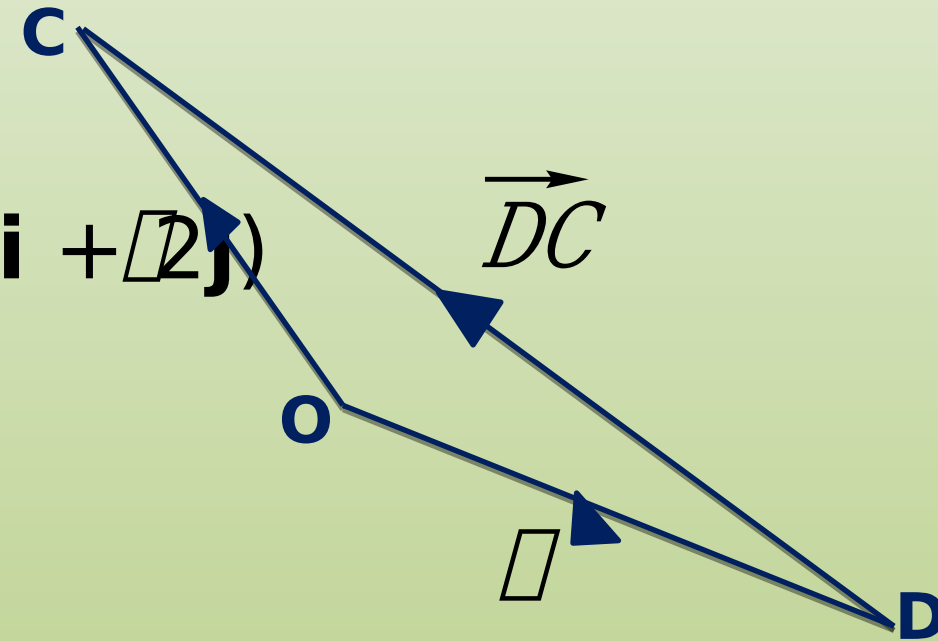
Consider the points with coordinates C(-1, 2) and D(4, -3).

b) Find the direction vector

$= -d + c$

$= -(4\mathbf{i} - 3\mathbf{j}) + (-\mathbf{i} + 2\mathbf{j})$

$= -5\mathbf{i} + 5\mathbf{j}$



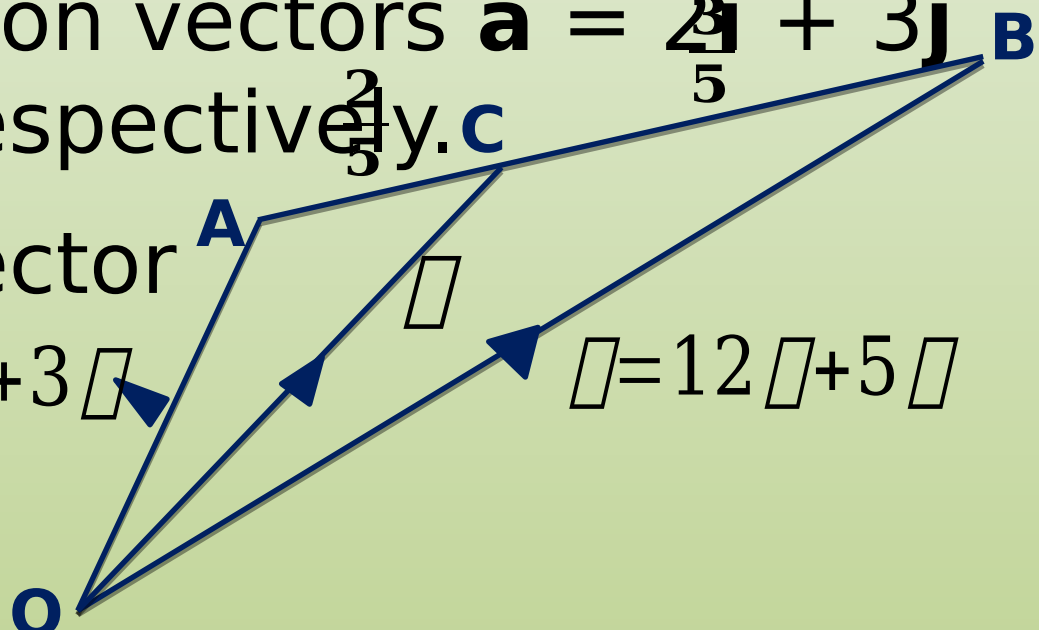
6.2 Components of a vector

Example 3

Points A, B and C are collinear, with C between A and B, such that AC : CB = 2 : 3.

A and B have position vectors $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j}$ and $\mathbf{b} = 12\mathbf{i} + 5\mathbf{j}$ respectively.

Find the position vector of point C, **c**.



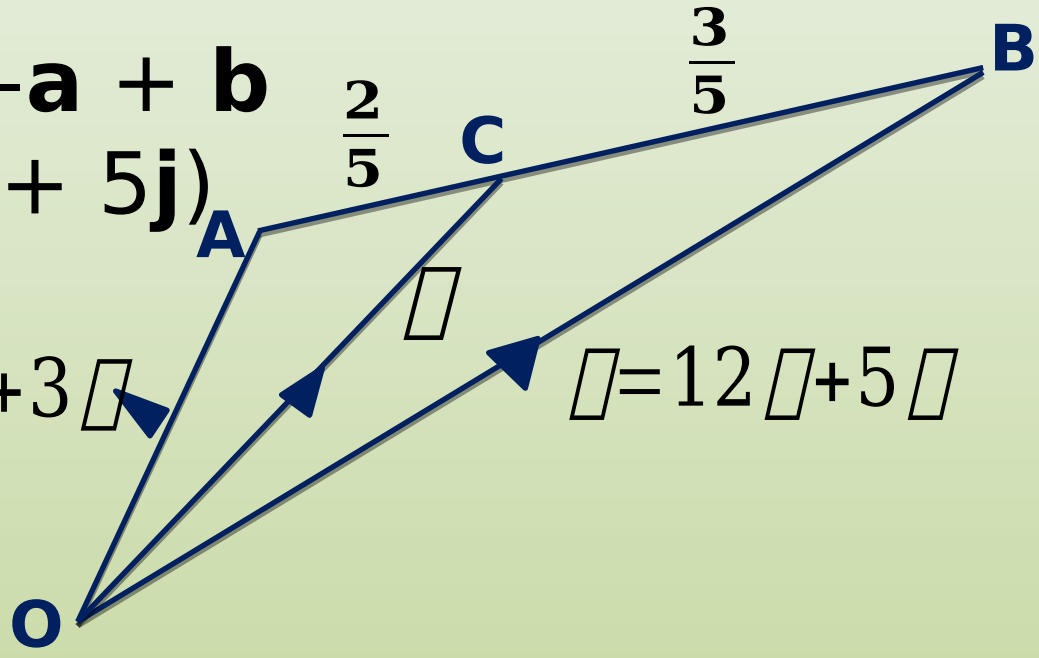
6.2 Components of a vector

Example 3

Find the position vector of point C, **c**.

Direction vector = -**a** + **b**
= -(2**i** + 3**j**) + (12**i** + 5**j**)
= 10**i** + 2**j**

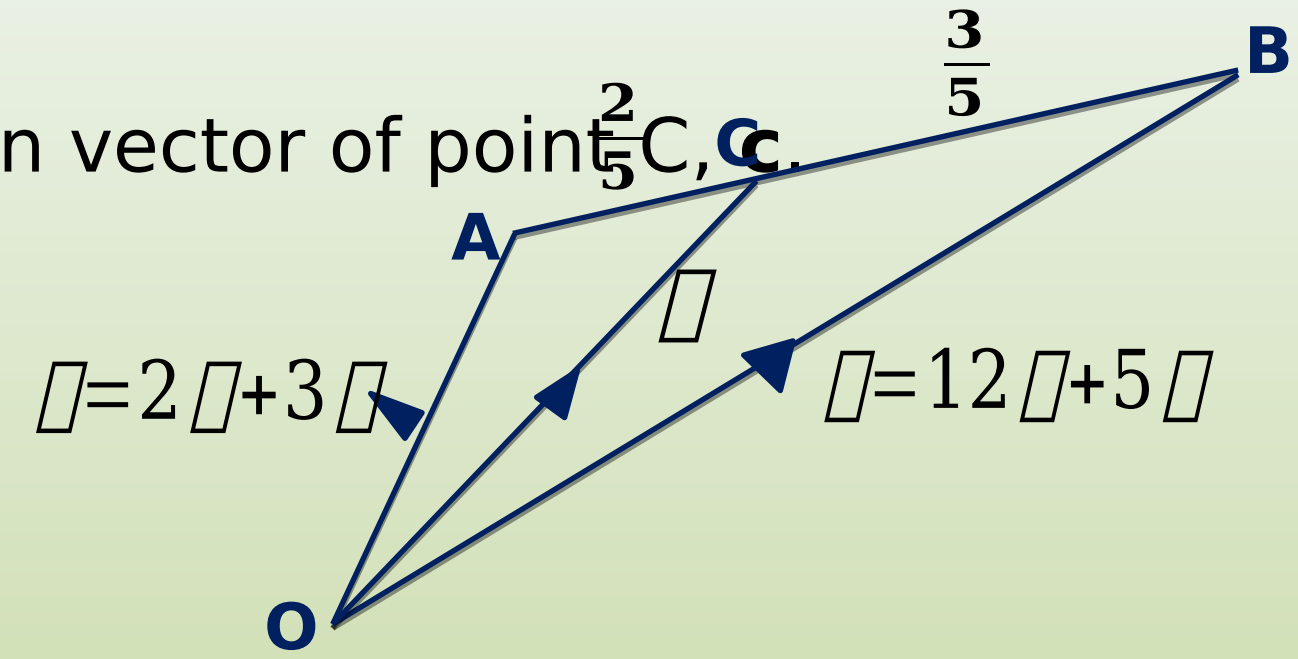
Direction vector =
= (10**i** + 2**j**)
= 4**i** + **j**



6.2 Components of a vector

Example 3

Find the position vector of point C, **c**.



= 10**i** + 2**j**

= 4**i** + **j**

position vector

c = (2**i** + 3**j**) + (4**i** + **j**) = 6**i** + **j**

c = 6**i** + 3.8**j**

Exercise 6.2A Q8-12